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PLATES AND ILLUSTRATIONS

GARDEN PIER, Atlantic City.
- Exterior View, Plate LXXXIII
- Lobby, Theatre, Plate LXXXIV
- Loggia, Plate LXXXV
- View from Beach, Plate LXXXVI
- Center Pavilion, Plate LXXXVII
- Tower, Plate LXXXVIII
- Detail of Tower, Plate LXXXIX
- Kiosk at Entrance, Plate XC
- Plan and Elevation, 144
- Arcade, Dance Hall, 145
- Detail, Theatre, 145
- Interior, Theatre, 146
- Kiosk, 146

Simon & Bassett, Architects.

CITIZENS SAVINGS BANK, Stamford, Conn.
- Exterior, Plate XCI
- Banking Room, Plate XCII

Louis E. Jallade, Architect.

RESIDENCE, J. Frederic Kernochan, New York.
- Exterior, Plate XCIII
- Entrance, Plate XCIV
- Dining Room and Plans, Plate XCV

Cross & Cross, Architects.

OHIO STATE UNIVERSITY LIBRARY, Columbus, O.
- Exterior, Plate XCVI
- Plans, 147
- Main Staircase, 148
- Reference Hall, 149
- Standard Literature Room, 149

Allen & Collens, Architects.

HOUSE, B. L. Goodkind, St. Paul, Minn.
- Exteriors, 150-151
- Plan, 152
- Dining Room, 153
- Library, 153

A. H. Stem, Architect.

"ARCHITECTURE" SERIES OF MEASURED DETAILS, No. 25.

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EDITORIAL

"OR EQUAL"—ARCHITECTURAL RENDERING OF TO-DAY—THE PROBLEM OF SEWAGE DISPOSAL WITH SPECIAL REFERENCE TO THE CITY OF NEW YORK

MY DEAR MR. FORBES:—

In reply to your inquiry with an enclosed clipping from the editorial page on the subject of "Or Equal," I am very glad to give you my opinion for what it may be worth.

I do very truly believe that when a man wants a certain material, and knows that it is good, he should specify it without the words "or equal," if, and here is the big question, he can do it without injustice to his client. Of course, in the case of patented or unique articles, there can be no mistake made in specifying without the words "or equal," since the article specified evidently has no equal in the sense in which the architect specified it. But these articles are after all comparatively few, it is the great mass of generally used building materials which your advertisers are endeavoring to familiarize us with, so that we will always specify them by name. *If we could be sure that the definite statement that we would accept no other goods but those specified, would not instantly raise the price of the article to our contractor and consequently to our client, or if we could be sure that no amount of bargaining would reduce the price, we would probably be willing to specify goods by their trade names without "or equal," except in those cases where city or state authorities refuse to permit the specification of a single brand.*

I know by experience in several lines that when I have specified certain material without "or equal," that I have not been able to get as good prices as I have for the same material with "or equal." As long as manufacturers are willing to conduct their business in this way it is not fair to ask the architects to specify their goods without the addition of the words "or equal," but if manufacturers had the courage to do what practically every decent retail merchant in the United States does, and that is to establish a fixed rate and publish the price so that there is no possibility of bunk, and after he has fixed his rate and published his price stand right behind it, I think he would instantly reap the benefit and lift the whole business to a different plane. It is not that we are not willing to pay, or let our clients pay for exactly the things they want, but we cannot fairly ask our clients to pay a little more than the man next door is doing, because we want to encourage a particular brand. We are paid not only to design houses for our clients, but to get them built as cheaply as they can be properly done, and if we knew and could tell our clients in advance just what they would have to pay for materials which enter into the construction, we could specify without the words "or equal" with more confidence than we now can. It might be that if a single manufacturer started publishing prices and sticking to them he would be underbid by other manufacturers of substantially similar materials, and the architects might go to the cheaper men. It is exactly this thing which has happened with the women of the House Wives' Leagues in different parts of the United States; they have united to discourage fictitious values, but when some big concern has cut down prices below their honest values they have deserted the men who are selling at reasonable figures with a result that their well meant efforts have in the end eliminated competition, and produced conditions exactly contrary to those which they desired. I am not prepared to say that the architects would not do the same thing, but I do not believe that this would be the case. I think there are a sufficient number of far-sighted and intelligent men who are conversant with the real values of materials to make it well worth any manufacturer's while to publicly announce the cost of his wares and to stick to those costs, and, as I said before, I am very heartily in favor of specifying exactly what I want and insisting that I get it, but at the present time it is not possible to do this with the whole range of building materials.

I am afraid this letter is going to be disappointing to you for I know you are a very firm advocate for the specification of a single brand, but I think that the reason the single brands are not specified is not the fault of the architects, but the fault of the manufacturers who are willing to do everything in the world for the architect except to be honest with him about prices as they are about quality.

Yours very truly,

* * *

ARCHITECTS are really up against a very serious problem in the increased cost of the preparation of competition drawings, and of sketches. Ten years ago free hand pencil sketches and the roughest sort of plans were all that was needed to show a client; to-day we produce an elaborate water color which might be exhibited in the exhibition of landscape work, rendered plans of the grounds and of the different stories, and the actual expense of the preparation of these drawings, aside from any study which goes into them is liable to eat up the whole amount of the fee paid for the sketches. Besides this there is a real dearth of men who are competent to render them, and the architect who is fortunate enough to have one of these men in his employ, or who can readily command the services of one of them, has a meretricious advantage over the architect who relies upon an ordinary office staff, since pretty pictures will often clinch a client who could be convinced by no amount of real design.

Competition drawings have increased in cost in a precisely similar manner, in spite of the fact that the gentlemen who have written the programs for these competitions have endeavored in every way to keep the competitors down to a reasonable standard of work. It is said that the drawings submitted in the recent New York County Court House competition averaged a cost of $5,000 for each competitor, a total of over $250,000, which was practically contributed to the City of New York out of the pockets of its architects, and yet the drawings required by the committee were no more than were necessary to show the scheme, and the committee expressly endeavored to make the renderings as simple as possible in character. It is a condition of affairs to which it is difficult to see any limit; if one of the members of the firm of Smith & Jones has the facility to execute a lovely competition drawing which will distract the eye from a possibly bad design, the firm of Robinson & Brown, who are good designers but bad renderers, are going to hire the best man they can get to compete with Smith & Jones.

The salaries asked by some of the more skillful draughtsmen during the New York County Court House competition were absolutely astounding; in one case it was reported that one man asked $200 a week, and the man in question though good, was not one of the best known of our renderers. We see no solution of this tangle, and can make no suggestions, but knowing the general interest in the subject to all architects we ventured to bring the matter to their attention, hoping that some one may be able to throw a little light upon it.

IT is a rather curious fact that the city of New York has, through some of its officials, taken a stand against the further pollution of waters of New York bay by sewage from the trunk line sewer in the Passaic Valley. We thoroughly agree that the present method of sewage disposal in almost all American cities contiguous to the water is deplorable, and that no further pollution should be permitted. But when we consider that New York is a city of 5,000,000 inhabitants, more or less, and that the new Passaic Valley sewer will serve a population of about 200,000, the position of New York seems untenable, unless it too intends to correct its own faults. The condition of the harbor of New York and of the Hudson River as far as tide water extends is something which the next generation will regard with horror and amazement, and the sooner the inhabitants of the city and the surrounding territories, which in fact (although not in name) constitute part of the city, awake to the deplorable conditions now existing, the better it will be for the health and comfort of us all. Nor is the problem of sewage disposal in New York City irremediable, or remediable only at great expense; it is of course obvious that the entire destruction of the present water borne sewage disposal system of New York and its reconstruction would involve an expense impossible even to that enormously wealthy city, but when the lay out of the sewers is considered, there seems a solution so obvious, one is surprised that it has not been given wider publicity. The present sewer system consists of gravity sewers from the center of Manhattan Island flowing into the river on either side, and other sewers, partly gravity and partly pressure, in the other parts of the city, but all emptying into the water front at the foot of the streets. Practically our entire water front is bounded by marginal streets, and were trunk line sewers to be established around the entire water front in these marginal streets, the termini of the secondary street sewers could at a very low expense, comparatively speaking, be connected into the trunk lines, and the whole conducted to purification beds situated perhaps in one of the remote and unpopulated parts of Long Island. No engineering problem of any great importance would be presented, the character of the soil, both on the side streets and on Long Island is such that construction would be easy and cheap. Trunk line sewers under the East River would be far simpler and cheaper to build than the railroad tunnels which now pass under it, and a few central pumping stations properly located would take care of the principal mechanical difficulty. A gravity system would of course be out of the question. Disposal beds would necessarily be very large, but aside from their size would present no new question, and modern disposal beds are not objectionable, either in smell or in appearance. This question, which is so vital to New York, is a crying one throughout the entire country, from the largest cities to the smallest villages. In laying out sewage systems the first thought is to find the nearest water to pollute, whether it be the Atlantic Ocean or a tiny brook, and it is a condition as dangerous as it is extraordinary. We can hardly imagine an American village running open sewers down its streets with any complacency, and yet American villages by the thousands straddle brooks and little rivers which are nothing more than open sewers without the slightest sign that they realize there is anything amiss in their locations. The difference between the American method and the continental method of the use of river systems is perhaps the most convincing proof of the rawness of our civilization. English, French and German rivers are *clean,* and are utilized to the utmost extent both for commercial traffic and for pleasure boats, and the contrast between the Seine, clean and inviting in the middle of a city of 3,000,000, and the Passaic with a population of 200,000 along its banks, and so foul that under certain tidal conditions it is almost impossible to stay in comfort within a quarter of a mile of it; it is disgusting. The Hudson is, of course, immensely larger than either the Seine or the Passaic, but the condition of the Hudson at certain times of the tide is already becoming —well—noticeable, nor can we with the present expansion of population along its banks continue to expect that it will remain noticeable only at times. New York harbor, the Hudson River, and the other waters surrounding the city of New York should be the most wonderful place in the world, for every sort of recreation associated with water, they should be the home of a vast pleasure fleet, and baths should be almost continuous along its shores, but in its present condition only those who regard dirt with indifference will use its waters, and these are not perhaps the people who desire to use them for that purpose.

GARDEN PIER, ATLANTIC CITY

SIMON & BASSETT, ARCHITECTS

A RADICAL departure from accepted ideas or combinations has its dangers and this, with the usual precedent lacking, made the designing and building of the Garden Pier at Atlantic City, N. J. a most difficult task. The problem, viewed solely from its aesthetic side, presented wonderful opportunities, but the practical and commercial sides demanded most serious consideration. The impossibility of ascertaining with accuracy the load that the ocean bed would safely hold made it necessary to design the buildings, using the materials that would make the dead load on the piers as light as possible and to arrange the dead and live loads in many units, thereby reducing the total load at any one point to the minimum. This was possible except in the case of the concentrated loads under the main building where in some cases it was necessary, especially in the theatre, to have clear spans of 75 feet. These concentrated loads varied from 100 to 325 tons, and required larger foundations described below. The division of the lighter loads into smaller units permitted a large factor of safety with the minimum cost of construction.

It was decided to use reinforced concrete for the piers of the sub-structure, which conclusion has since been proven correct, for during the severe storms of last winter the pier suffered no damage. These concrete piers vary in size according to the superimposed loads. For the ordinary deck load where the promenades occur, an octagonal reinforced concrete pile, averaging 25 inches in width, was used. These piles were jettied down not less than twenty feet below the ocean bottom, and in some cases thirty feet. Where the piers supported concentrated loads of the main building circular concrete foundations were used. These foundations vary from six to nine feet in diameter and in all cases are carried down at least forty feet below the ocean bottom. Between the high and low water levels all the concrete piles and foundations are covered with galvanized steel cylinders as a protection from the ice which at times is dashed against the piers with tremendous force. The transverse girders over the piling and piers are of reinforced concrete. Over these girders and securely belted to them are 4″ x 18″ yellow pine joists forming a longitudinal brace as well as a support for the deck planting.

Having aimed to design a substructure with a minimum cost of maintenance the same thought was followed in the designing of the superstructures, evolving buildings with structural steel frames, hollow terra cotta tile walls, Spanish tile roofs, and copper cornices. The use of these materials made necessary a style of architecture to which they could be successfully adapted, viz.: Spanish Renaissance. This at once demanded a dignified composition of the masses, and permitted of a quaint and playful treatment of the color scheme.

Thus upon entering the Pier from the Boardwalk one is impressed at once with the broad plazas flanking the central garden scheme with the interesting group of low buildings on either side of the plaza, forming a dignified approach and surroundings, leading up to and allowing of an unobstructed view of the main building, situated about 400 feet oceanward. The garden arrangement adds materially to the general effect of the entire scheme, and is now being used as an exhibition ground for specimen plants by one of our largest nursery firms. The treatment of the groups of low buildings is most interesting as the entire plaza fronts are practically all of glass held in place with bronze frames with intermediate column supports of polished granite. Above the plate glass bulks is a band of ornamental polychrome terra cotta in deep blues and reds which, combined with decorative tile panels in many harmonizing colors, applied in the warm gray stucco fields, the great overhang of the roofs and the deep red Spanish tile roofs in variegated tones, produce a most comfortable and pleasing result.

The main building is 175 feet wide and 200 feet long with a central arcade about 25 feet wide and 30 feet high throughout its entire length, giving an ample and dignified entrance to the pier beyond.

On the one side of the arcade is a theatre 75′ x 200′ and the other side a dance hall of the same size. The main entrance, or lobby of the theatre, has been treated in a unique manner with plain unglazed, fire-flashed Flemish tile, while the floor is in variegated reds and the side walls in gray tones relieved by the discreet application of faience borders and decorative inserts symbolistic of the dramatic art. One of the interesting features in this group of rarely interesting buildings is in the handling of the tile and mosaic used so extensively on both exterior and interior. The setting is done with exquisite care and understanding of design and texture. Art and craftsmanship have formed a happy combination. The curved ceiling is in a warm gray tone, arranged with simple borders in rich reds, while mural paintings in tones to harmonize with the general color scheme are placed above the tile wainscoting on each of the circular panels formed by the curved ceiling. A most unusual effect is produced by the use of concealed lighting behind the cornice moulding at the intersection of the tile side walls with the ceiling. The theatre has a seating capacity of 2,200 and, due to its extreme length, the acoustic problem required most careful thought which was solved by having one balcony with the side walls and ceiling arranged very much like a megaphone with the proscenium opening as the mouthpiece. One can hear perfectly from any seat in the building.

The ventilating of the theatre was a most interesting question. This was solved by bringing the fresh air supply through the floor of the building directly over the ocean and blowing it to the various parts of the auditorium by means of ducts and fans. This fresh air is passed over heaters in winter and by-passed direct to the auditorium in summer, making a very simple yet efficient ventilating system.

In order to avoid interference with the acoustics of the auditorium the side walls and ceiling were ornamented with plaster in low relief. The plain surfaces were decorated in warm gray tones with the ornament in old gold with spots of soft blues and reds. The hangings and draperies are of rich gold velour with the seats upholstered in leather in soft brown tones, making a pleasing contrast to the bright red floor coverings.

The dance hall with its floor space of 15,000 square feet and ceiling height of sixty feet permitted of a monumental yet attractive scheme of decoration. The colorings are Pompeiian with a black base paneled in gold. Above the base is a field of mural paintings in soft colors with paneled borders in rich reds and blues. The introduction of statuary and plants produces the atmosphere the use of this room demands.

The exterior of the main building with four towers 120 feet high make a most imposing result. The hollow tile exterior walls are stuccoed in a warm gray tone with a heavy stippled finish. The trimmings, similar in color to red sand stone, are of ornamental terra cotta, and in conjunction with the frieze, elaborate decorative tile panels have been executed in faience. It was necessary to develop a tile which was frost and weather proof beyond a doubt as the conditions at the seashore are exceptionally severe. The tile does not show the least sign of disintegration or change in color, and it may be said that another problem connected with the advent of polychrome tile has been solved. The sloping portion of the roofs are covered with a variegated red fire flashed Spanish tile which makes a pleasing combination with the color scheme of the other portions of the building.

Directly beyond the main building and connected to it by means of a covered pergola is the restaurant located in a structure much smaller in scale than the main building yet with the same treatment of the exterior. The interior is decorated in Pompeiian colorings similar in character to those in the dance hall which give this room the quiet atmosphere so much to be desired in rooms used for dining purposes, and this added to the beautiful outlook oceanward satisfies the most critical.

Thus instead of the light and somewhat frivolous style usually applied to buildings of this character, the architects have chosen the more massive and monumental style, hoping to make the Garden pier a permanent architectural feature of our greatest American resort.

I. ENGINEERING FOR ARCHITECTS

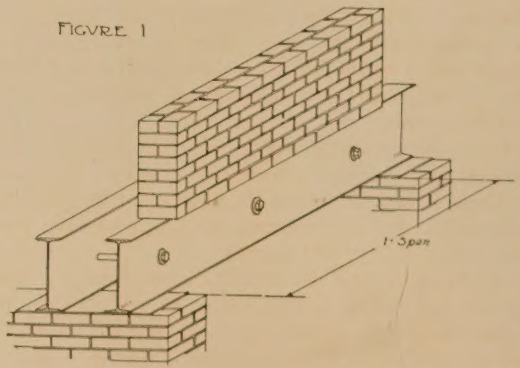
BY DeWITT CLINTON POND

Mr. Pond has charge of the practical course in structural design at Columbia University. He has been extremely successful in instructing men who have had little knowledge of mathematics, and these articles have been written with that in view.

THE object of these articles is to explain simply, and plainly, the few secrets of engineering, so that an architect can decide for himself the size of beams, girders, and column sections necessary for construction. The solutions of these secrets are very simple, and no knowledge of mathematics beyond simple algebra is necessary. If the architect or draftsman will follow these discussions carefully, and bear in mind that all of this work is by no means difficult, he will find there will be no secrets of engineering that he cannot solve for himself. The architect is cautioned to keep from making a mystery of an essentially plain subject.

A handbook, such as published by the Carnegie or Cambria Steel Companies, should be obtained. The possession of such a book is absolutely necessary. A slide rule may be used, but for the simple calculations that an architect may find necessary, a slide rule is hardly essential.

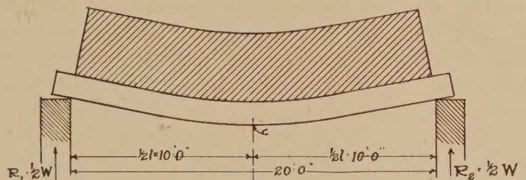
For the first problem we can take a beam, properly braced with tie rods, which carries a brick wall (Fig. 1). The span, usually denoted by the letter "l", will be taken as twenty feet, the wall to be eight inches thick and fifteen feet high. The question is to find the size of an I-beam which will carry such a load. It will be assumed that the wall is fresh laid—the mortar "green"—and that there is no "arch action" caused by the bonding of the brick.



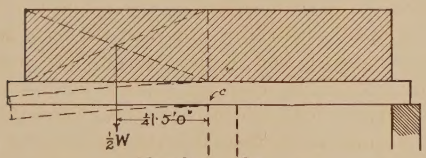
In this case there are two things to be considered: first, the stresses set up in the beam by the external loading—the brick wall, and, second, the ability of the beam to resist these stresses. The architect must keep these two considerations clear and absolutely distinct in his mind.

Taking up the first consideration, engineers generally assume that the external load can make a beam fail in two ways: first, by bending, as shown in Fig. 2 and, second, by shearing, as shown in Fig. 3. Shearing means that type of failure caused by forcing the particles of a beam to slide by each other. When a hole is punched in a steel plate the metal is "sheared" out. Bending sets up stresses of compression and tension which will be considered in the next article. Failure by bending will be considered first.

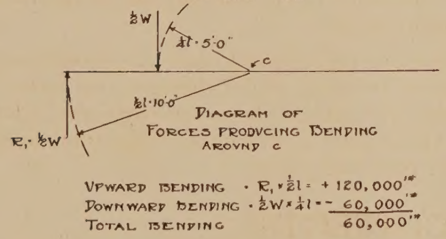
In this problem the wall is considered as distributing its weight uniformly over the entire beam, and the beam is said to be "uniformly loaded." In such a case, one half the load is carried by each support. The wall is twenty feet long, fifteen feet high, and two thirds of a foot thick and the number of cubic feet it contains is given by the following simple multiplication, 2/3 x 15 x 20=200 cubic feet.



FIGVRE 2



FIGV'RE 2a

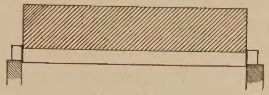

$\frac{1}{2}W$
$\frac{1}{4}l \cdot 5'0''$
c
$\frac{1}{2}l \cdot 10'0''$
$R_1 \cdot \frac{1}{2}W$
DIAGRAM OF
FORCES PRODVCING BENDING
AROVND c
VPWARD BENDING $\cdot R_1 \times \frac{1}{2}l = +120,000'^{\#}$
DOWNWARD BENDING $\cdot \frac{1}{2}W \times \frac{1}{4}l = -60,000'^{\#}$
TOTAL BENDING $60,000'^{\#}$

Engineers consider brick as weighing one hundred and twenty pounds per cubic foot, although the New York Building Code gives the weight as one hundred and fifteen pounds. The weight of the wall is, therefore, 200 x 120=24,000 pounds.

The weight coming down on each pier is twelve thousand pounds, and each load is known as the left, or right, reaction. The left reaction is usually denoted as R_1, the right reaction as R_2, and the equation that expresses the above relations is $R_1=R_2=12,000$ pounds.

It is obvious in this case that if the beam fails by bending, it will fail in the middle (point c, Fig. 2), ten feet from either support. The tendency to produce bending in the beam, at this point, is found in the following manner.

When bending is considered, the term "moment" is always used, and, at this point, the first definitions must be agreed upon. A moment is the *tendency to produce rotation* about a point. The point is known as the "center of moments" and the moment itself is equal to the product of the force, tending to produce rotation, multiplied by its *perpendicular* distance from the center of moments, known as the level arm. In the language of college students, a moment equals "force time distance" or "force times lever arms."



FIGVRE 3

A scale is shown in Fig. 4. Either weight W or W′ can be taken as the *force*, the point c is the *center of moments,* and the distance d or d′ is the perpendicular distance from W or W′ to c. If W should drop to the position shown by the dotted lines, d would equal zero and W x d=0. There would be no tendency to rotate around c and in other words there would be no moment. No force, acting *through* a point, produces a moment.

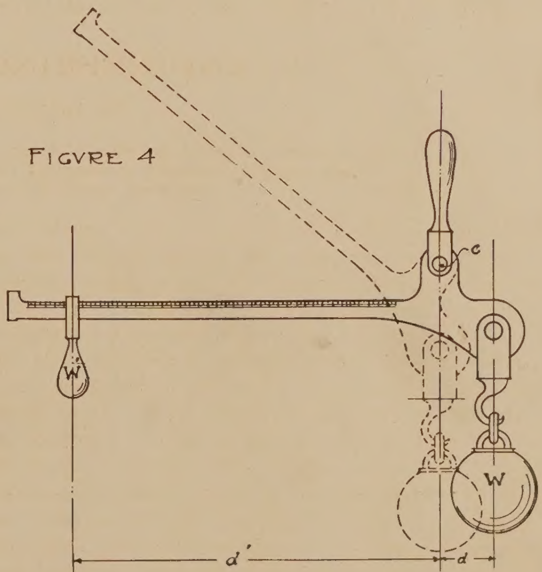
Since moments are the products of forces and distances they must be measured in units of force and distance, such as "foot-pounds" or "inch-pounds." If a force of five pounds acts at a distance of two feet from a point, the moment will be ten foot-pounds or one hundred and twenty inch-pounds.

No bending is produced unless a moment exists, hence moments are often referred to as "bending moments" and are denoted by the letter M. The force is usually denoted by the letter W and the perpendicular distance, or lever arm, by small 1. So M=W 1.

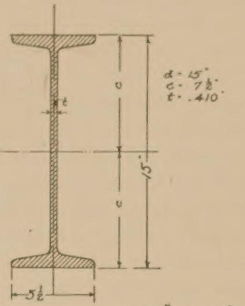
If the beam in figure one is to fail by bending there must be a moment to cause this bending. The moment must act around the center of the beam (c). Now the left reaction (R_1) may be considered as an *upward* force and the moment caused by R_1 equals the force, 12,000 pounds, multiplied by the distance, 10 feet, or 12,000 pounds x 10′= 120,000 foot-pounds.

If R_1 were taken from its position at the end of the beam and placed, as shown by dotted lines in Figure 2a, just to the right of c, it is obvious that the section of the brick wall at the left of c would tend to bend the beam *downward.* The moment tending to produce this bending, of course, must be the product of a force multiplied by a

FIGVRE 4



distance. The force in this case is equal to the weight of one half of the wall or $\frac{1}{2}W = 12{,}000$ pounds. The lever arm is the distance from c to the center of gravity of this half of the wall or, in this case, five feet, which is equal to $\frac{1}{4}$ l. The moment equals 12,000 pounds multiplied by 5 feet or 60,000 foot-pounds. This downward moment exists around c in all cases even with R_1 in its proper position.

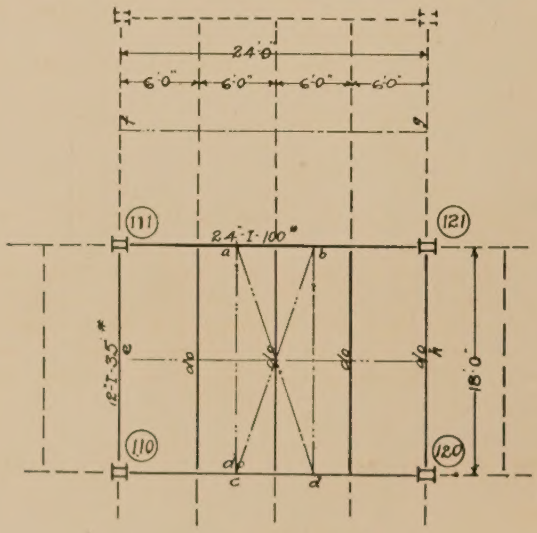


SECTION OF A 15"-I-42#
FIGVRE 5

With the reaction acting *upward* and one half the load acting *downward*, the total moment around c must be $(R_1 \times 10) - (\frac{1}{2}W \times 5)$ or $120{,}000 - 60{,}000 = 60{,}000$ foot-pounds or $60{,}000 \times 12 = 720{,}000$ inch-pounds. It is obvious that the bending moment at the right of c is equal to that at the left or $(R_1 \times 10) - (\frac{1}{2}W \times 5) = (R_2 \times 10) - (\frac{1}{2}W \times 5) = M$.

If this were not so, rotation would take place around the center point c which, in the case of a beam, never happens.

The above discussion is given to show a method of finding the maximum bending moment caused by a uniform load on a beam, but, as a rule, this method is too long, and a formula can be used that will give the same results with much less work. The method of deriving the formula is much the same as used in the above discussion. $R_1 = \frac{1}{2}W$, and the moment of R_1 around c equals $R_1 \times \frac{1}{2}$ l or $\frac{1}{2}W \times \frac{1}{2} l = \frac{1}{4}Wl$. The downward moment equals $\frac{1}{2}W \times \frac{1}{4}$ l or $\frac{1}{8}$ Wl. So the total bending moment around c equals $\frac{1}{4}Wl - \frac{1}{8}Wl$ or $\frac{2}{8}Wl - \frac{1}{8}Wl = \frac{1}{8}Wl$.



FIGVRE 6

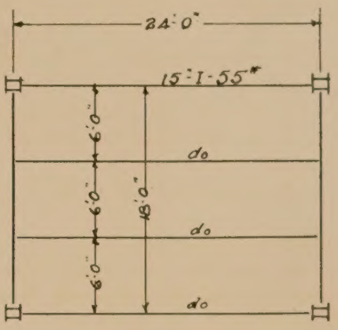
The formula, $M = \frac{1}{8}Wl$, is the one always used to find the maximum bending moment in a beam carrying a uniform load. It is, perhaps, the most useful formula employed by engineers and its application in the above case would be as follows:

W=24,000 pounds, $l = 20'\text{-}0'' = 240''$, $\frac{1}{8}Wl = \frac{1}{8} \times 24{,}000 \times 240 = 720{,}000$ inch-pounds.

If the beam is to fail by bending it will fail because of this bending moment of 720,000 inch-pounds and if we wish to select one that will carry the brick wall a beam must be selected that will resist this moment. This is the consideration spoken of in the first part of this article, namely, the ability of the beam to resist the stresses set up by the external load.

The bending moment that a beam will withstand is given by the formula, $M = S\ I/c$.

M is the bending moment, S is the *safe working stress* of the material of which the beam is made. In the case of steel, S is always taken as sixteen thousand pounds per square inch and in the case of wood from eight to twelve hundred pounds per square inch is all that is allowed. These safe working stresses are given in the building code. I is the symbol always used to denote the "Moment of Inertia" which will be explained later. The letter c is the distance from the most remote fibre to the center (center of gravity) of the beam.



FIGVRE 6a

Open the Cambria Steel Company's handbook, 1912 edition, to page 158, or an old Carnegie handbook to page 97, or the "Pocket Companion," published by the Carnegie Steel Company, 1913 edition, to page 142. In the second column from the left, under the heading "Depth of Beam," a fifteen inch I-beam is found that weighs 42 pounds (Cambria) or 36 pounds (Carnegie, 1913). The Cambria beam will be considered first.

The area of the cross section is 12.48 square inches. The thickness of the web, "t," is 41/100 of an inch. The flange is $5\frac{1}{2}$ in hes wide and the moment of inertia or I is 441.8. Obviously, as the depth of the bea is fifteen inches, the distance c (Fig. 5) is $\frac{1}{2} \times 15 = 7.5$. So $I/c = \frac{441.8}{7.5} = 58.9$.

I/c is known as the "section modulus" of the beam, and this is given in column 8, so for any steel beam it is unnecessary for the architect or engineer to go through this simple form of division.

In the formula $M = S\ I/c$, for any standard section of I-beam, channel, or angle, we have every factor known but the bending moment, M. For this particular fifteen inch, forty-two pound, I-beam the moment can be determined by simply substituting in the formula as follows: $M = 16{,}000 \times 58.9 = 940{,}000$ inch-pounds, approximately, and this is the bending moment that the beam will withstand. As a rule, M is known and I/c, the section modulus, is the unknown factor. Such is the case with the simple beam carrying the brick wall. M, in this case, is 720,000 inch-pounds. To determine the size of the I-beam required, the formula would be written as follows: $M = 720{,}000$ inch-pounds $= 16{,}000 \times I/c$, or $I/c = 720{,}000/16{,}000$. $I/c = 45$.

Looking down column 8 in the hand book 58.9 is the next value for I/c above 45, so a 15″-I-42℔ is required to carry the wall.

If we consider the Carnegie handbook, the fifteen inch I-beam, weighing thirty-six pounds per foot, will have a section area of 10.63 square inches, a flange width of 5½ inches, with a web thickness of 289/1,000 of an inch. The I, or moment of inertia, of this beam is 405.1, and as $c = \frac{1}{2} \times d = 7.5$, $I/c = \frac{405.1}{7.5} = 54$, which is found in the column marked "S" in the Carnegie book. "S," in the handbook denotes the section modulus or I/c. So a 15″-I-36lb would withstand a maximum bending moment of $M = 16{,}000 \times 54 = 864{,}000$ inch-pounds.

Following the calculations given for the Cambria beam it is easily seen that this 15″-I-36℔ will carry the brick wall.

The second method of failure is due to shearing and in this case the beam might fail in this manner rather than by bending as a brick wall is practically rigid after the mortar is set.

The shear is always greatest at the supports and is equal to the reactions. Looking at Fig. 3 it might be imagined that the wall acts like a punch—tending to punch the beam between the two supports, and the force exerted at each pier is equal to each reaction.

Therefore the maximum shear in the beam equals 12,000 pounds.

Steel will safely stand a tensile stress or pull of 16,000 pounds per square inch, but its shearing value is only 9,000 pounds per square inch, as allowed by the New York Building Code, Section 139.

The cross section area of the Cambria beam, as given in the hand book, is 12.48 square inches. If the shearing strength of the steel is 9,000 pounds per square inch and there are 12.48 square inches, naturally the shearing value of the cross section is $12.48 \times 9{,}000 = 109{,}320$ pounds. The beam is undoubtedly safe.

It is a significant fact that although moments are measured in foot-pounds or inch-pounds, foot-tons or inch-tons, as the case may be, shearing values are measured in pounds or tons only. If the architect finds that he is trying to measure moments in terms of weights only, he had better stop and consider that it would be as impossible to do this as to measure a mile with a quart measure. The unit does not fit the condition.

The maximum shear is always found at the reactions and when the reactions are unequal the greatest shear is found at the greatest reaction.

As a rule beams are seldom figured to withstand shear as long beams are more apt to fail by bending. However, in the case of heavy loads, carried over short spans, failure by shearing must always be considered. The bending moment caused by a heavy load over a short span will be small as the maximum moment equals ⅛Wl and l in this case is small. If the beam is designed only for the purpose of resisting this M, it might easily be too light to resist the shear.

In the foregoing problem, a single case is given where a uniformly distributed load is considered. Another, and probably the most frequent case, is found where the beam is one of a series of "filling-in beams," as shown in the section of a steel framing plan (Fig. 6). A girder is "framed" between columns 120 and 111, and another between columns 121 and 111. Filling-in beams, spaced six feet on centers, are framed between the girders. The floor area carried by each beam is shown enclosed in the space *adcd*, and is equal to 6′-0″ x 18′-0″=108 square feet. Assuming a floor load of 200 pounds per square foot, then the total load on each beam is $108 \times 200 = 21{,}600$ pounds $= W$.

The span of the beam is 18′ 0″ or 216″ and so the bending moment equals $\frac{21{,}600 \times 216}{8} = 583{,}200$ inch-pounds,

$M = 583{,}200 = S\ I/c = 16{,}000 \times I/c$. $I/c = \frac{583{,}200}{16{,}000} = 36.4$.

In the handbook a 12″-I-35℔ will be found having a section modulus of 38.0 which will be satisfactory for this condition.

The architect can make problems for himself, such as assuming a floor load of 175 pounds or a span of 20 feet in place of 18 feet. If the beams and girders were framed in opposite directions, as shown in Fig. 6a, the beam would have a span of 24 feet and therefore 15″ I-beam, weighing 55 pounds per foot would be necessary.

If, in Fig. 6, we assume that the girders carry a section of the floor area enclosed by the lines ef, fg, gh, and he, the floor area will be 18 feet by 24 feet, or 432 square feet. $432 \times 200 = 86{,}400$ pounds $= W$.

$\frac{1}{8}Wl = \frac{1}{8} \times 86{,}400 \times 24 \times 12 = 3{,}110{,}400$ inch-pounds.

$M = 3{,}110{,}400 = 16{,}000 \times I/c$, or

$I/c = \frac{3{,}110{,}400}{16{,}000} = 194.4$.

Therefore, the girders would have to be 24″ I-beams, weighing 100 pounds per foot.

The method of figuring floor loads as well as a little more theoretical consideration of the principles involved in the above discussion will be taken up in the next article. For the present it may be well for the architect to "check up" the sizes of beams shown on any steel framing plans that he may have.

REFINEMENT IN DESIGN

BY S. E. JONES

That the act of refinement is mainly the art of eliminating seems a just interpretation of the term "refinement" as applicable to architecture; for to refine is to purify, and this surely entails something being cast out.

TO know what to leave out is often the whole art of knowing what to put in. Where extraneous and meaningless additions are eliminated, we are left with the natural and necessary. It is a mark of incompetence to omit the necessary and pile up the superfluous. The architect grounded in the "canons" of his art—as we say, without knowing what we mean, but possibly intending to convey the idea of one possessing a large amount of plain common sense—will endeavor to render beautiful some necessary feature, say, a window, and take a genius's infinite pains even over the humble sash-bars, seeing in these necessaries as fitting subjects for thought and consideration as cathedral mullions. Those who rest satisfied with any kind of hole in the wall for window-opening, and make a medley of sash-square proportions, will, likely as not, hurry on to fritter away plain wall surface, ruin an honest brick gable with sham "half-timber," and cut and crinkle a hundred and one senseless conceits. How, but by omitting the whole hash, could we breathe refinement into such work? The art of eliminating the unnecessary might well be preached as a first principle.

That the act of refinement is mainly the art of eliminating seems a just interpretation of the term "refinement," as applicable to architecture; for, to refine is to purify, and this surely entails something being cast out. Since nowadays we rather suffer from a plethora of ages old, ready-made architectural properties, we may do well to consider the art of refining as primarily, and, by preference, the art of eliminating superfluity and insincerity, more especially the latter, as affecting construction and its expression. Viewed in this light, refinement and simplicity must often go hand in hand, and so are not, as some seem to fancy, contrary attributes. If, further, we regard refinement in design as the result of the elimination of the coarse and commonplace, we may confidently assure ourselves that in refining a composition, or in refining detail of plan or elevation, we are not, as a rule, adding to, but most generally decreasing, the number of parts and features—lessening the sum of aesthetic impedimenta reared upon the back of plain, unoffending building.

Doubtless, there is also the positive aspect of refinement, as this term may apply to the evolution and perfecting of architectural design. In refining, as when "working up" a simple theme to a higher order and phase, we may elevate the elemental to a loftier plane. It is refiners' work to obliterate ugly gashes and prominence, in ridge lines; it is also a refinement to soften, by subordinate additions, the garish baldness of a railway-station type of roof. In both instances we, either by a positive or negative process, eliminate the uncouth and offensive. Such a view of the meaning of refinement in architecture is elevating, because it necessitates real mental effort, and is not akin to French-polishing, or the mere rendering of an object sleek and smooth. The furnace of thought is the designer's refining fire, wherein should be burned up the coarse, the alien, the superfluous, and, above all, the meaningless—that which has no practical motive or base. The less we view the act of refining as a mere matter of polish, the less likely will our efforts at refinement kill out all boldness, all expressiveness, all life and vigor.

To refine, we need sensibility; an appreciation of small change from any mean state, position, or condition; the kind of eye that sees, and the heart that feels, beauty in "the mud and scum of things"—a lively sentiment for infinite gradation, and an acquaintance with the differential calculus of aesthetics, as it were. We need power to estimate and esteem the significance of minute shades of difference. The small things that count are not in truth petty details, but the ultimate ends, the completion and consummation of the vital and basic. We should essay to refine, not when our minds are obsessed with the small things that do not count, but when power is given to grasp and transform an expansive whole. Certainly it is in small matters we refine, but these minutiæ are rather the incomplete parts of weighty affairs—offshoots and extensions of the serious and fundamental—to neglect which may reveal want of integrity and lack of resolute purpose. If we regard refinement in architectural design as a mere toning-down, smoothing and polishing process—an affair solely of this or that contour and mold—instead of adding to expressiveness, to grace and beauty, we shall engender the tame and insipid. Too frequently we mistake this for delicacy and elegance.

All true refinement in design seems an affair of infinitesimals; and this, no doubt, we can understand, seeing that the basic forms, the determining outlines of all we deal with, are time-old and threadbare with age, unless we can instil some small improvement awakening novel interest. We may see that a certain well-known form of antiquity has been through a refining fire; and that, very often, is all we can see, since the change from standard type is too minute to impress itself immediately upon our senses. And where improvements have been wrought for centuries, the possibility of further improvement becomes less, a peculiar mode or manner of design having reached its culmination; so that particular architectural details may, by their having long been perfected, become as little amenable to alteration as the circle. We may make a parody, we may subvert, or turn things inside-out; but this is in no sense refinement. Only long study and concentration of effort can accomplish a genuine improvement, and this is so shadowy, so slight and imperceptible, that, as we have suggested, we cannot at first comprehend wherein the refinement consists. Had we the necessary delicacy of appreciation, no doubt minor improvements on form long supposed unimprovable could be made. The fact that an average can always be struck and an "order" thus standardized, does not imply that the way for all further refinement is closed for ever. In a sense, all leaves on an oak tree are similar; they truly belong to a special "order"; it is no less true to say that no two such leaves are alike. If we are viewing such leaves as objects of beauty, and are keenly sensitive of delicate variation from some conventional, ideal form of oak leaf, infinitely varied interest is discoverable; each leaf possessing definite character, the result of some slight change from the hypothetical prototype. Could we fully appreciate this point, we should see that vast scope exists for refined variation on old architectural device, without real modification of the basic form.

Refinement in design should postulate real improvement, should, indeed, have some practical motive. It is not easy to see how we can render objects more graceful and elegant, unless every step we take is guided by some underlying motive. It would portend an advance in architecture as a living art if our designers were required to give a reason for every line not obviously arising from constructional necessity. We should have much plain building, and possibly be none the worse for it. We should see less that is unconstructional, and construction thereby would gain in expression. If, as a main result, our efforts to refine led to the elimination of purposeless form, by so much at least would contemporary architecture be purified.

It is a common observation, that we may over-refine. If we regard refinement as a mere polishing and smoothing process, no doubt the final outcome of such refining is the elimination of all boldness, all piquancy, all pleasing rotundity and fullness and vigor of form: the arris dulled, the bossy curve everywhere rendered sleek and oleaginous. The salt thereby loses its savor. We see much that is tame and flat, wanting in "go," and, no doubt, often the cause has been a mistaken idea as to the nature of true refinement. Maybe we have at times taken the Adelphi terrace too seriously.

The refined and graceful, the elegant and delicate, no doubt appear more so when contrasted with the rugged and coarse. It might be exaggeration to suggest that the creation of such contrast by definite juxtaposition of the rude to the fine may be a design principle; but if we differentiate between the bold, the rugged, and plain, and actual offensive and revolting coarseness, we have every reason for seeing in such contrasts a way to most effective and pleasing composition. The delicate twigs and actual branch ends of trees surely make harmony with the rough and gnarled bowl and trunks. Highly elaborated canopies grafted into bare walls, and shadowed by rude Norman arches, are infinitely pleasing. We become sensible of the value of the more refined architecture. In old French churches, often the bare, early arcading blossoms, here and there, with delicately-sculptored Flamboyant, reminding one of wild flowers and ground ivy twining about the rugged stems of hedgerow trees. Actual coarseness we cannot admit; but a certain elemental rudeness of method seems well suited to enhance that which is highly refined and delicate.

BOOK REVIEW.

THE PRACTICAL BOOK OF GARDEN ARCHITECTURE.—Phebe Westcott Humphreys. 1914. J. B. Lippincott Co. Philadelphia.

Whether the owner of a property supervises its ornamental development or places the work in the hands of a professional, the requirement of a practical book on the subject is equally great. If the first need is the more obvious, the second is quite as real, for how shall an owner be able intelligently to consider the plans and suggestions of his garden architect unless he himself has some adequate knowledge of the subject? Much waste of good money, much upheaval of work done and not liked, much dissatisfaction with the final effect have resulted simply from the lack of such knowledge as is compendiously given in this volume.

For the man or the woman who is supervising the actual work done, or perhaps even doing it with his or her own hands, this book will be found to supply practical directions of a specific character.

Of the first importance in any artistic work, simple or complex, is the correct point of view. The garden that is lived in and loved, whose architectural treatment has developed naturally in response to the growing demand for art out of doors, and in harmony with the house and its surroundings, will achieve far greater success than the "show garden" in which the architect has slavishly followed some prescribed canon of formal or naturalistic treatment. Repose and harmony must be the fundamental principles in blending the numerous accessories with picturesque and comfort-dispensing features in the little garden surrounding suburban homes, as well as in the landscape designs of spacious country seats.

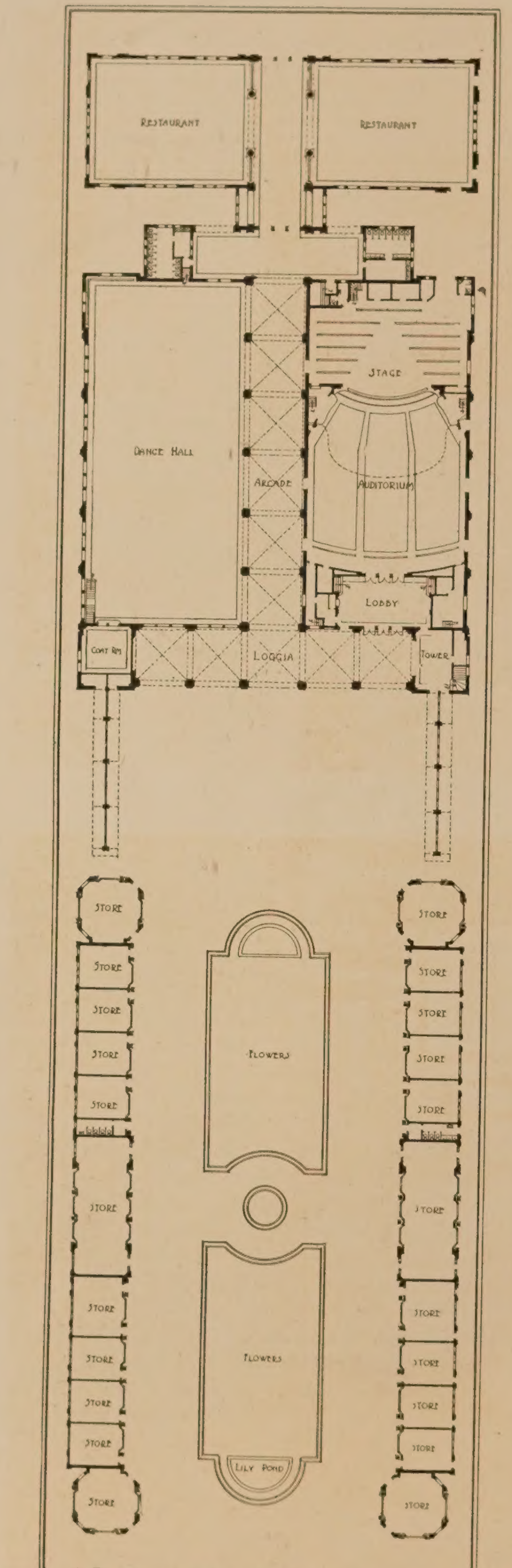
In preparing this practical book on architectural embellishment the author has endeavored clearly to demonstrate that garden beauty and harmony need not necessitate lavish expenditure. The most attractive features are shown to be within the means of the modest owner. The expense of building and maintenance has been materially lessened during recent years by many labor-saving devices unknown to the famous craftsmen of old-world gardens. It is, for instance, now possible to secure in cement excellent reproductions of fountains, temples, garden-seats, steps, balustrades, etc., formerly executed in marble; and, with the numerous labor-saving devices, their manufacture is within the capabilities of the average garden-craftsman. On the other hand, the wealthy proprietor who wishes to import genuine antiques of such objects or to have them specially designed will find among the illustrations excellent examples for his guidance.

Another important object in the preparation of this book is the warning against an overcrowding of supposedly desirable accessories. There are numerous American properties (including even some of those which are given as models in household journals) which are "horrid examples" of overdoing and incongruity. We must not overlook our natural trait—the average American wants too much, wants *everything* in one small stretch of territory. If it doesn't "belong" he will nevertheless force it in, especially if it happens to be the fad of the moment. Satisfactory results can be obtained only when each architectural feature admitted to the garden beautiful so fits into its surroundings that, however new it may be, it will when completed look as if it not only belonged there, but had always been there. There is no better test than this of good and bad forms of garden development. It means restfulness and repose instead of the uneasiness of effect too frequently encountered in the treatment of house surroundings.

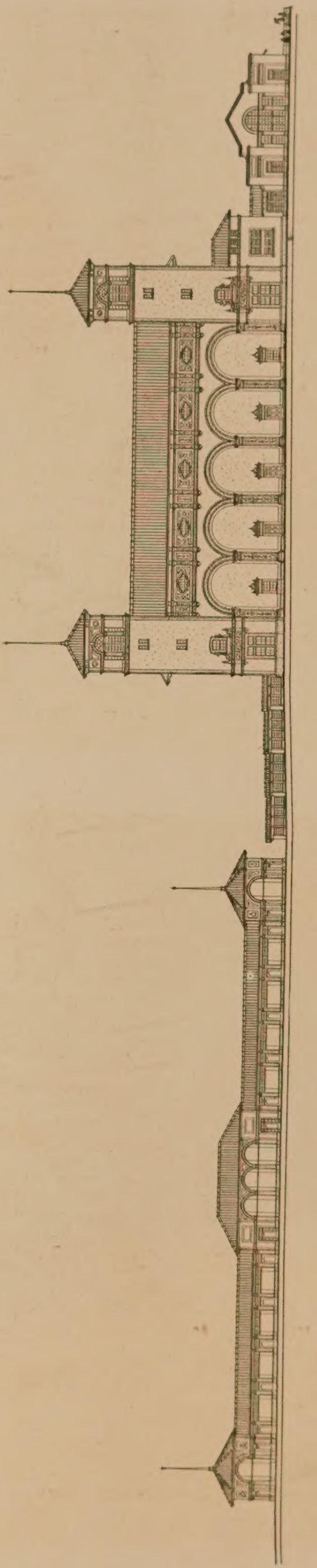
In the chapters where it has been necessary to describe and illustrate various forms in brick, stone, concrete, and rustic work, to show the distinctive designs pertaining to each type of garden architecture, an attempt has been made to present a wide range of choice to fit the requirements of every form of garden. It has been taken for granted that no one will make the mistake of assuming the responsibility of mixing these various types in any one garden, no matter how large and well screened. In treating of pergolas and similar features of garden architecture that have been extensively overdone in many localities, the caution has been especially emphatic against using them where they do not belong, and only where there is some reason for their existence. In portraying good examples of cobble walls, various effects in rough field stone, bark-covered logs, slab furnishings, and similar forms of rusticity, it has been shown that they are most attractive when used in the most rugged surroundings. In dealing with quaint and unusual types and fads in garden furnishings, an effort has been made to keep them in their appropriate places. For instance, among the various thatched roofs described for picturesque effects, an example is given of the best form of thatching houses—illustrated by a house photographed in Holland. But this does not indicate that the author would encourage the thatching of dwelling houses in this country, or that it is necessary to delve into the possible unsanitary and fire-breeding problems that might arise should thatched houses become popular. The thatching is considered simply as a pleasing type of roofing for rustic and picturesque features far removed from the dwelling house. The charm of simple, dignified treatment has been set forth as desirable for every form of garden. With the house as the dominant object in the home picture, all the various features of the architectural treatment of the grounds have been made subservient to it. This rule applies alike to the little garden enclosure in or out of town and to the spacious country estate.

AT a recent dinner of the Comité France-Amerique, held in Paris, Prof. Bergson's speech proved to be a charming synthesis of the impressions which he brought back from his visit to our country. He spoke enthusiastically of our wonderful institutions.

"About the supposed crudities of American life and the lack of artistic perception," he said, "I had certainly been misinformed. I must say that I found New York interesting to a fascinating degree and in certain respects beautiful. The so-called skyscrapers are in many instances not at all bad. The architectural tendency begotten by the exigencies of lofty construction has in it a good deal of originality. If I were to forecast a complete renovation of modern architecture I should say that the influence that would be most likely to bring it about would come from New York. And there is something in this thought that should minister to the just pride of Frenchmen, for the most eminent architects of New York are pupils of our own Ecole des Beaux Arts. I say to you now, much as it may surprise some of you, that skyscrapers may be agreeable to look at, and that many of them are beautiful. Of course I do not advise the immediate adoption of this system of construction in France, where the architectural physiognomy of the cities has been a matter of long development."



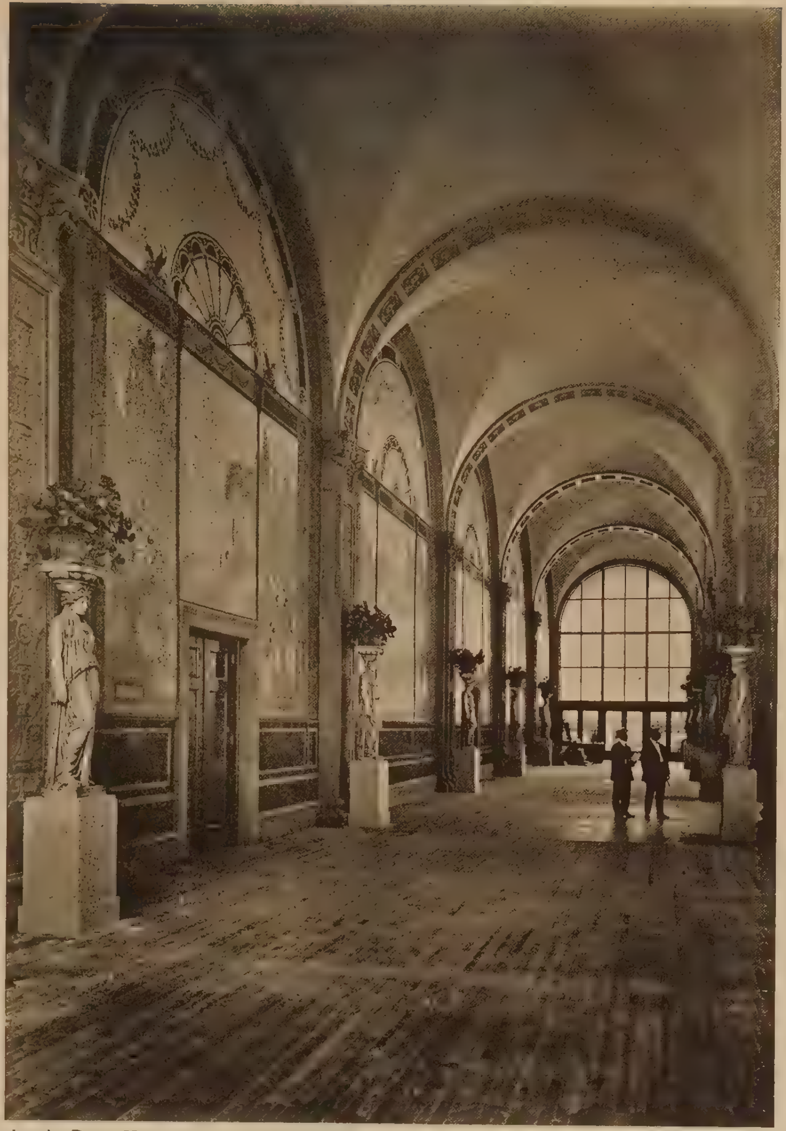
PLAN OF PIER AT DECK LEVEL



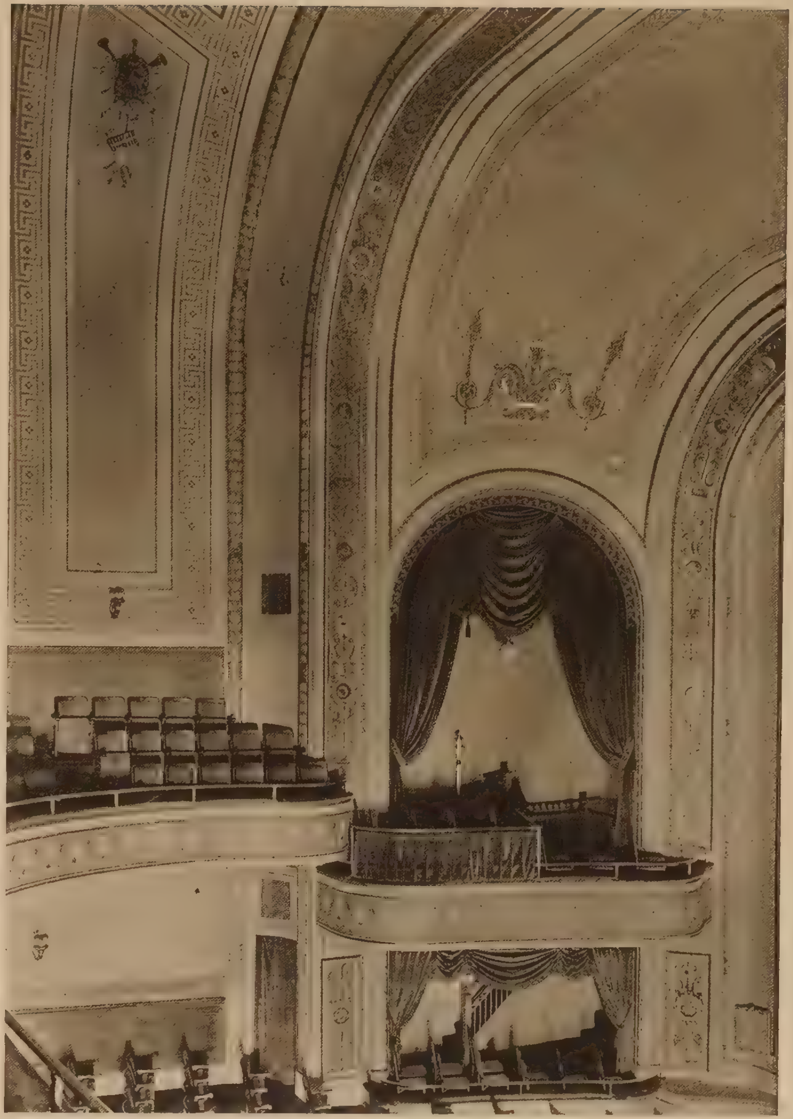
SIDE ELEVATION OF GARDEN PIER, ATLANTIC CITY, N.J.

ELEVATION AND PLAN, GARDEN PIER, ATLANTIC CITY

Simon & Bassett, Architects.



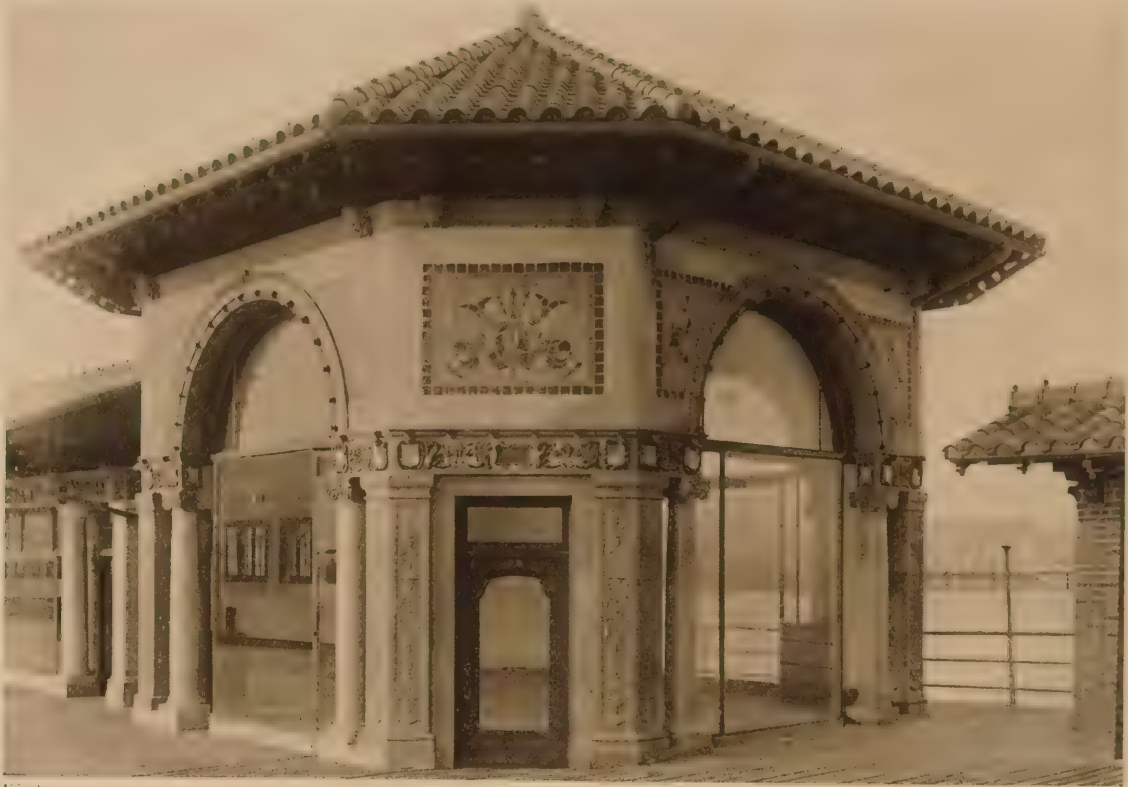
Arcade, Dance Hall.



Detail, Theatre.

GARDEN PIER, ATLANTIC CITY.

Simon & Bassett, Architects.



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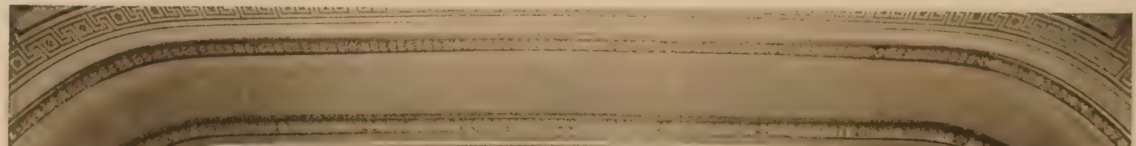
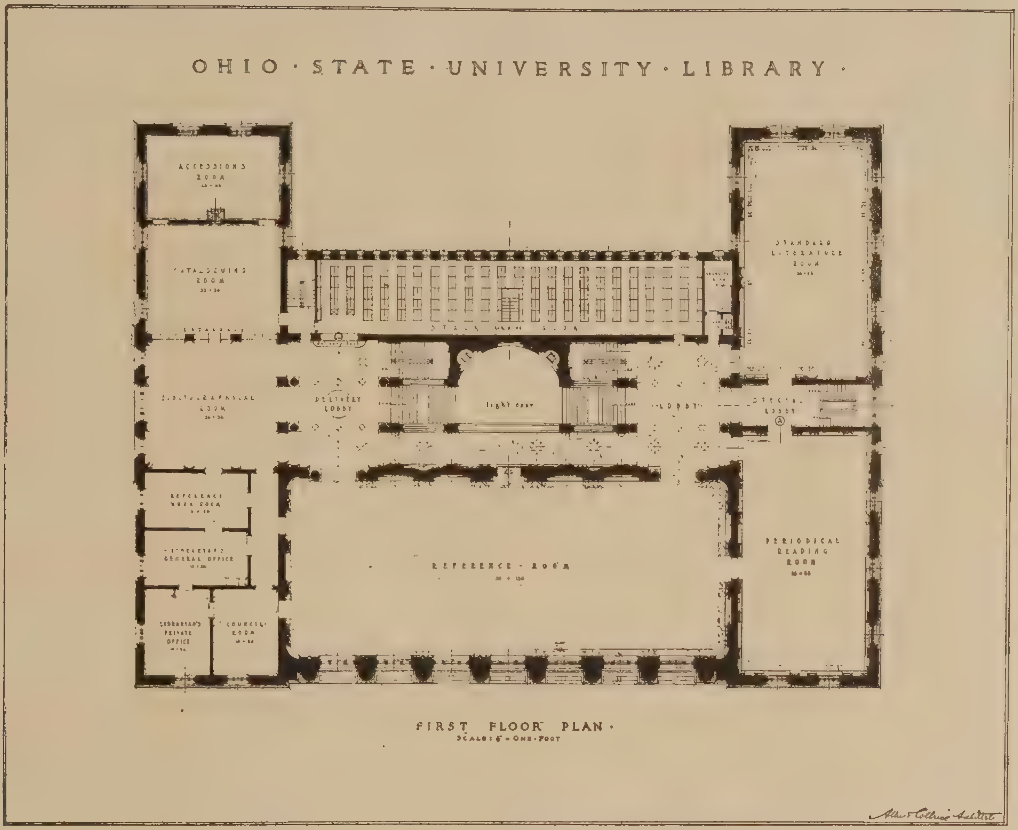


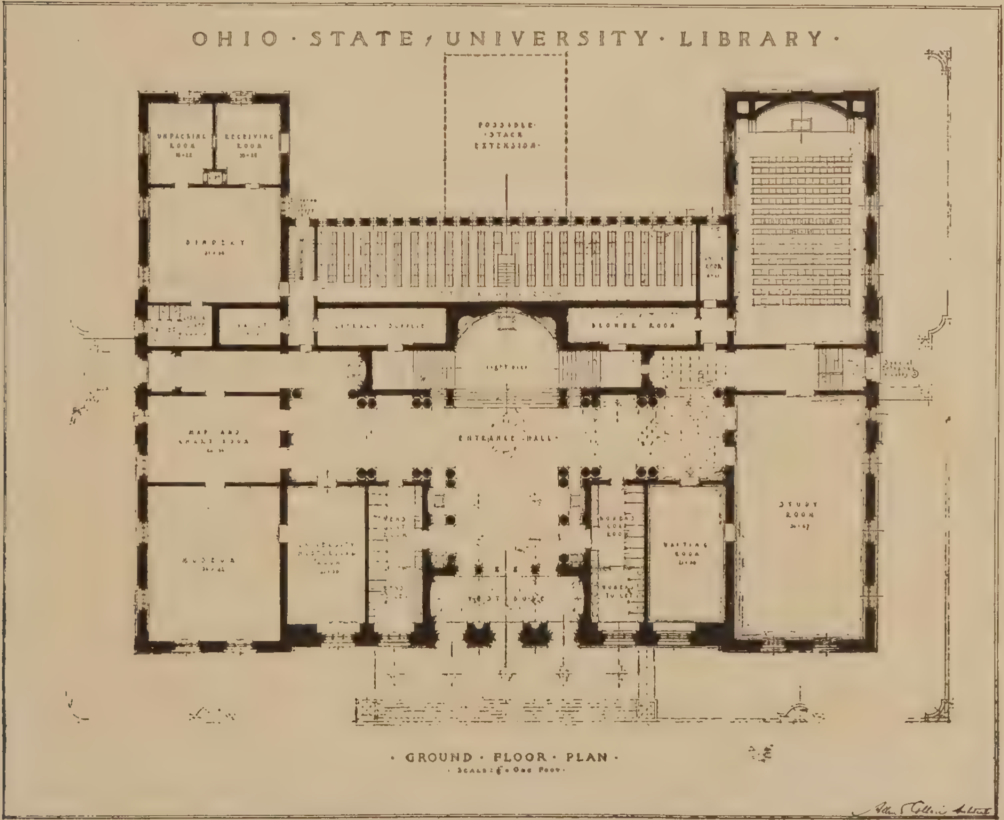
Interior, Theatre.

GARDEN PIER, ATLANTIC CITY.

Simon & Bassett, Architects.



FIRST FLOOR PLAN ·
SCALE 1/16" = ONE · FOOT



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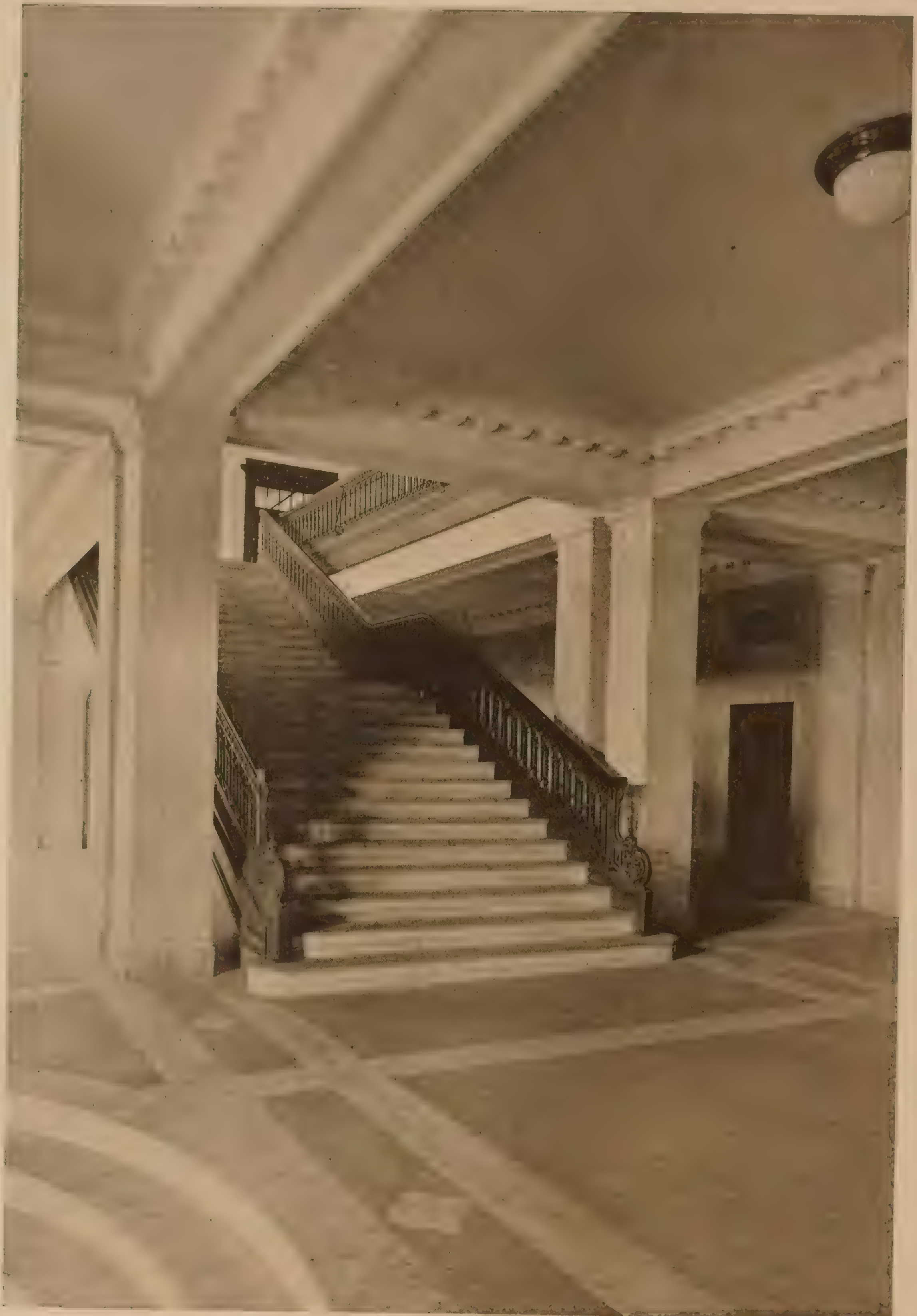
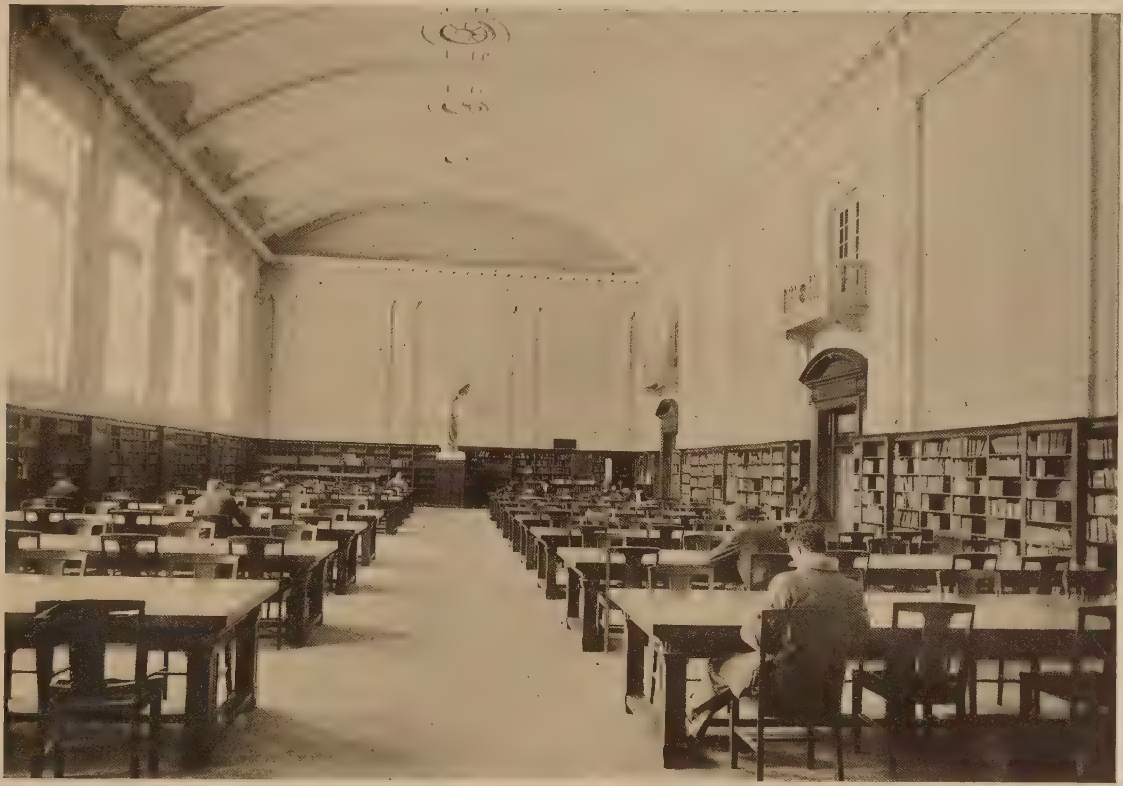
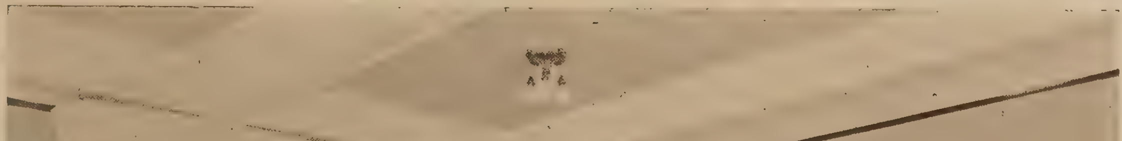


MAIN STAIRCASE, OHIO STATE UNIVERSITY LIBRARY, COLUMBUS, O.

Allen & Collens, Architects.

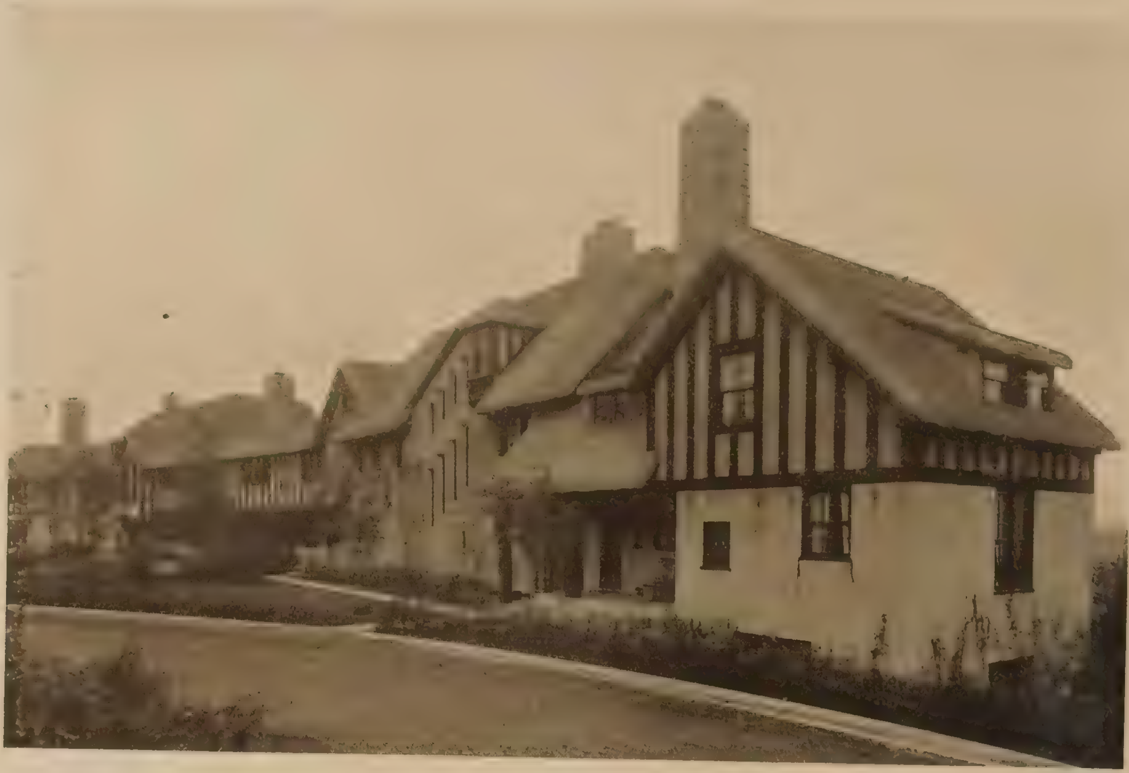


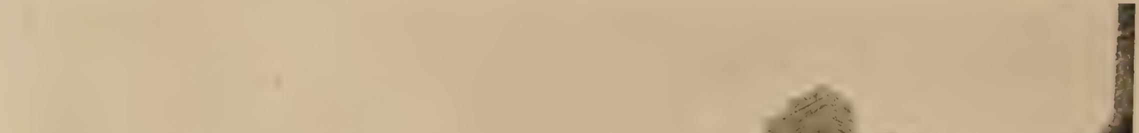
Reference Hall.



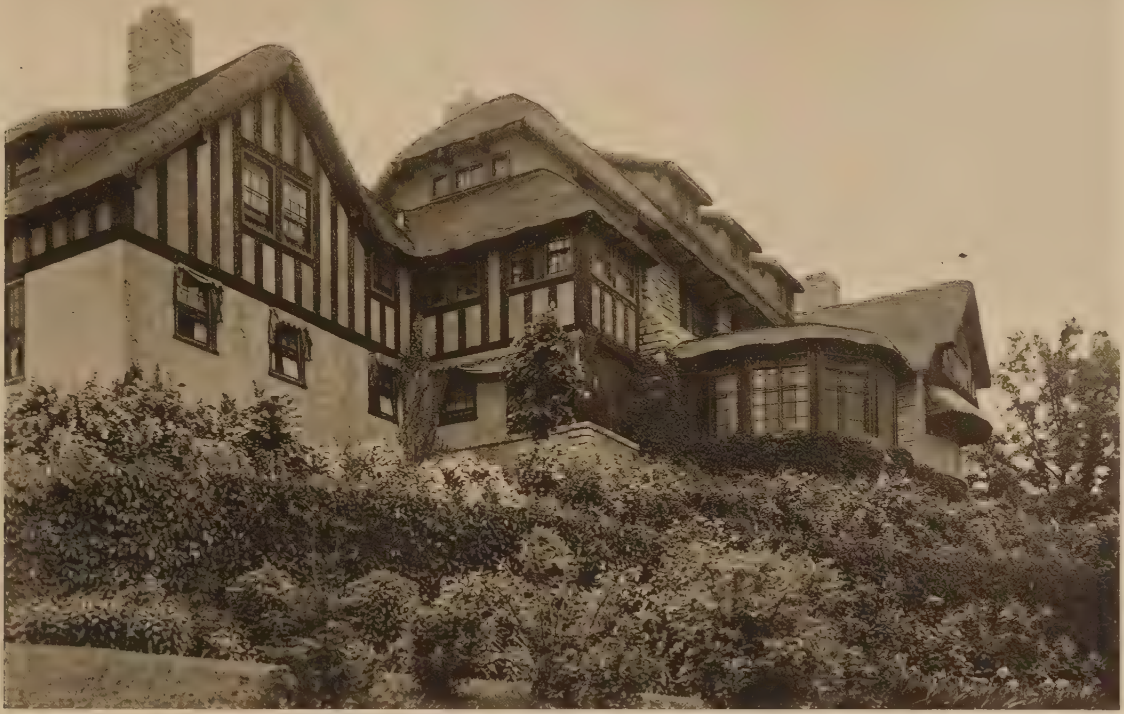
Standard Literature Room.

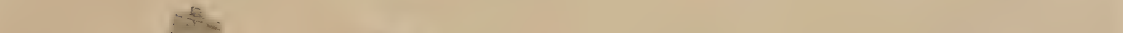
OHIO STATE UNIVERSITY LIBRARY, COLUMBUS, O. Allen & Collens, Architects.



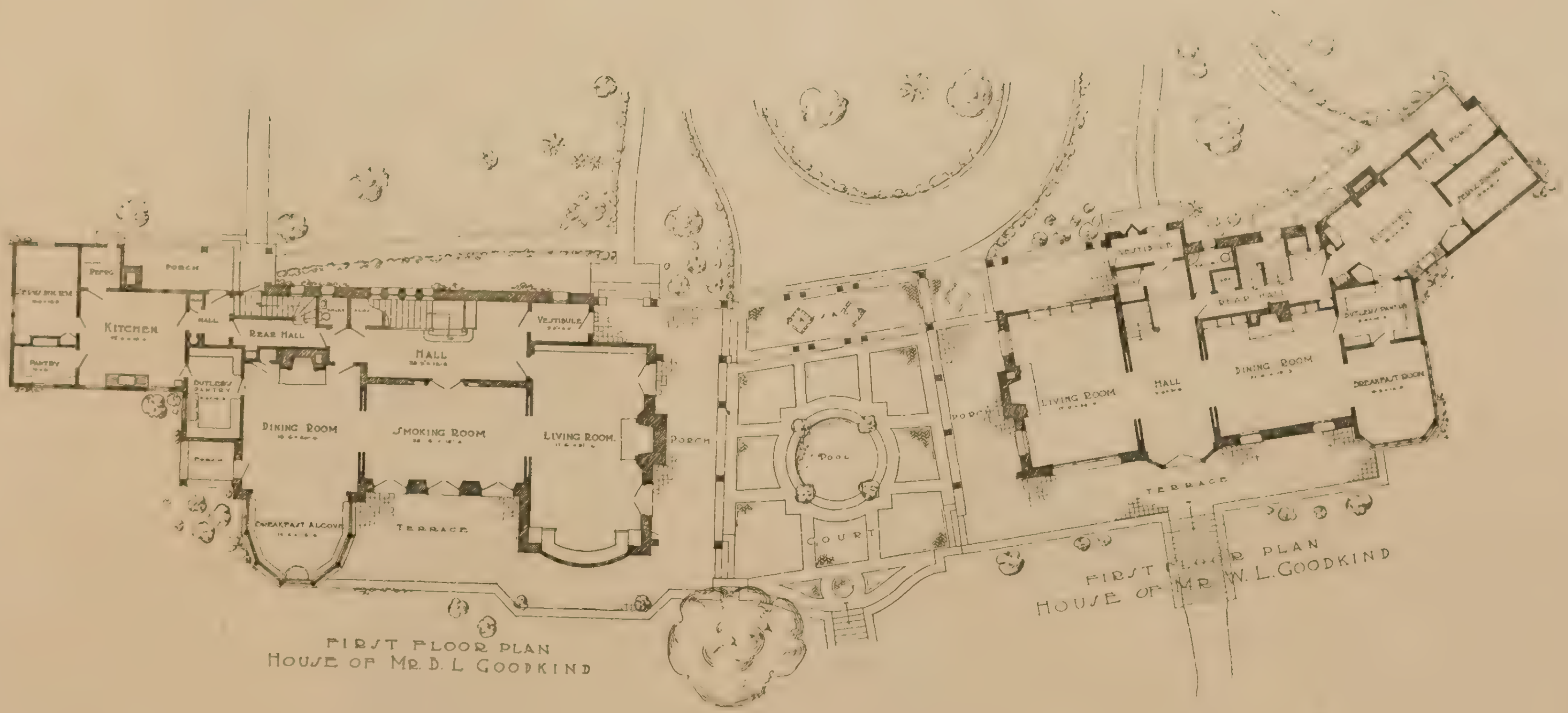


HOUSE, B. L. GOODKIND, ST PAUL, MINN. A. H. Stem, Architect.



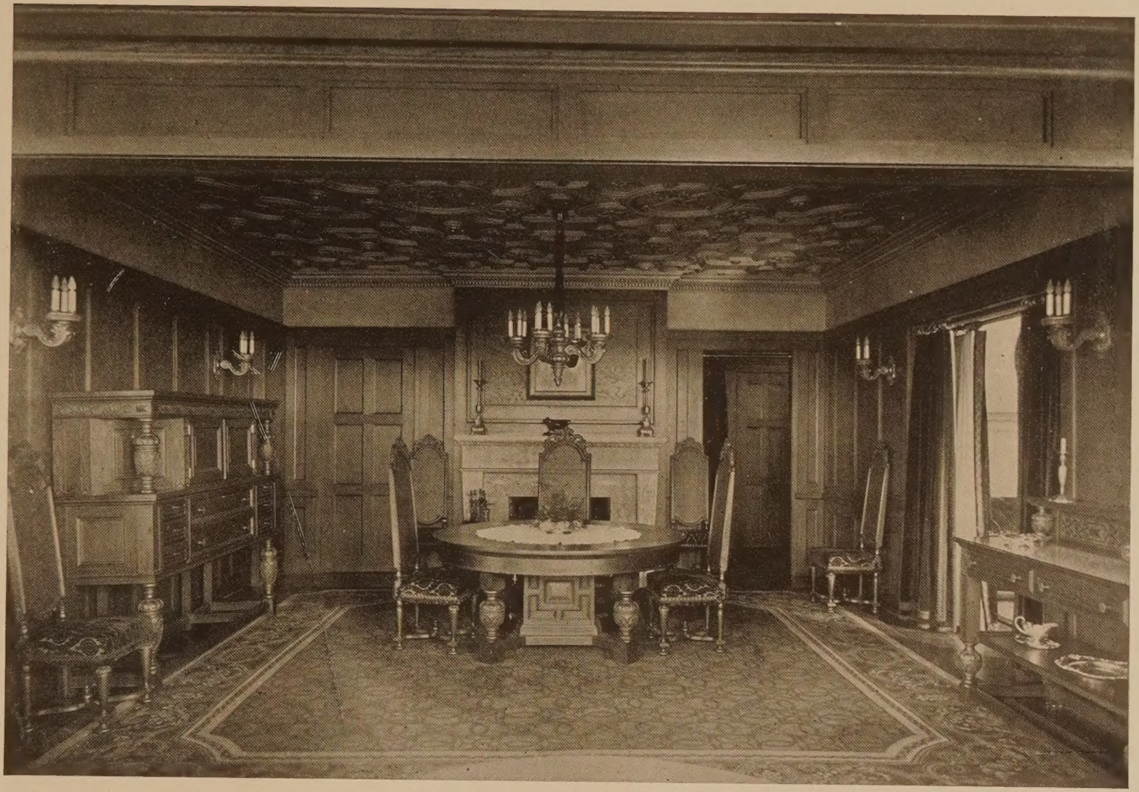


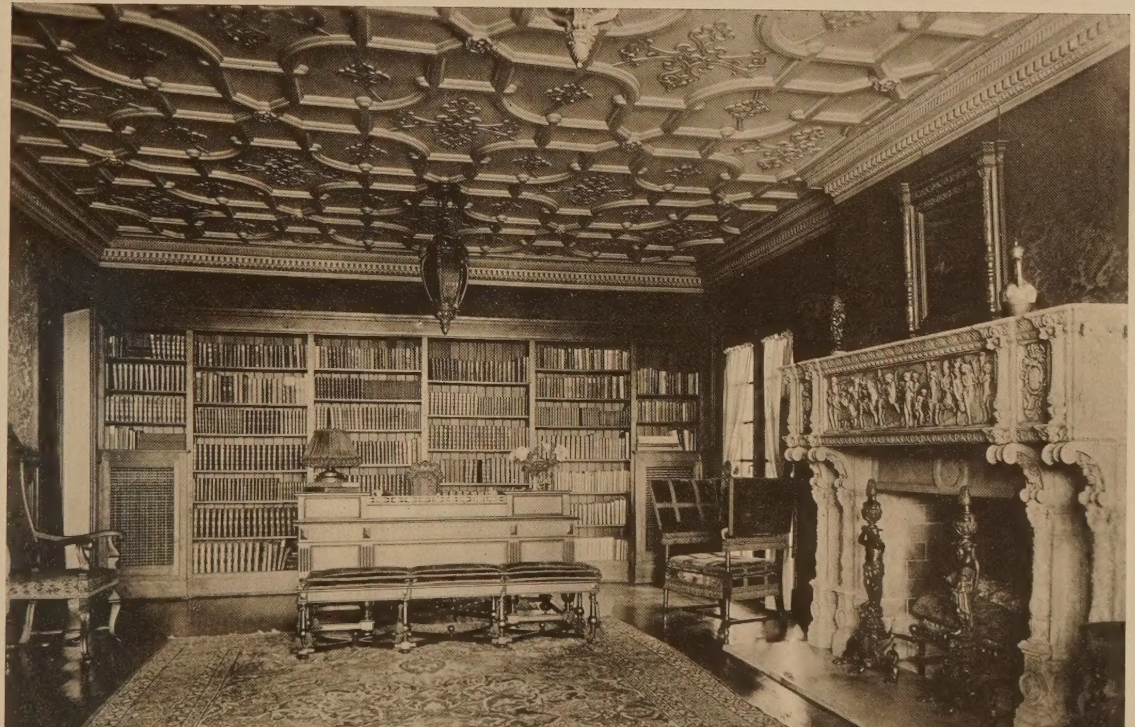
HOUSE, B. L. GOODKIND, ST. PAUL, MINN. A. H. Stem, Architect.



PLAN, HOUSES CONNECTED WITH COURTWAY. MESSRS. B. L. AND W. L. GOODKIND, ST. PAUL, MINN.

A. H. Stem, Architect



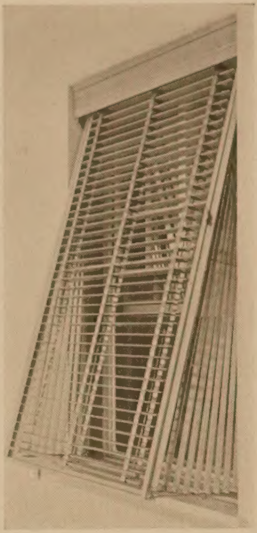


DINING ROOM AND LIBRARY, HOUSE, B. L GOODKIND, ST. PAUL, MINN. A. H. Stem, Architect.

WILSON'S

AWNING

BLINDS



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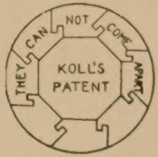

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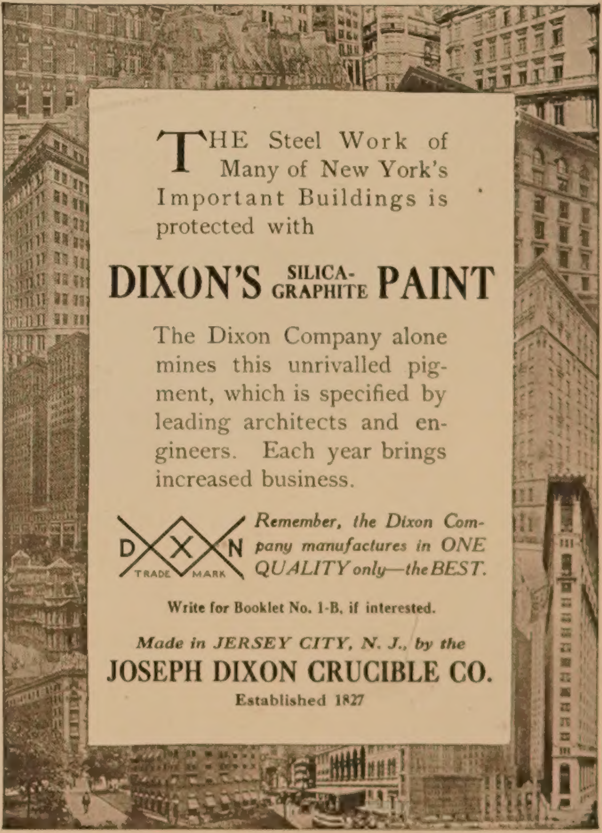

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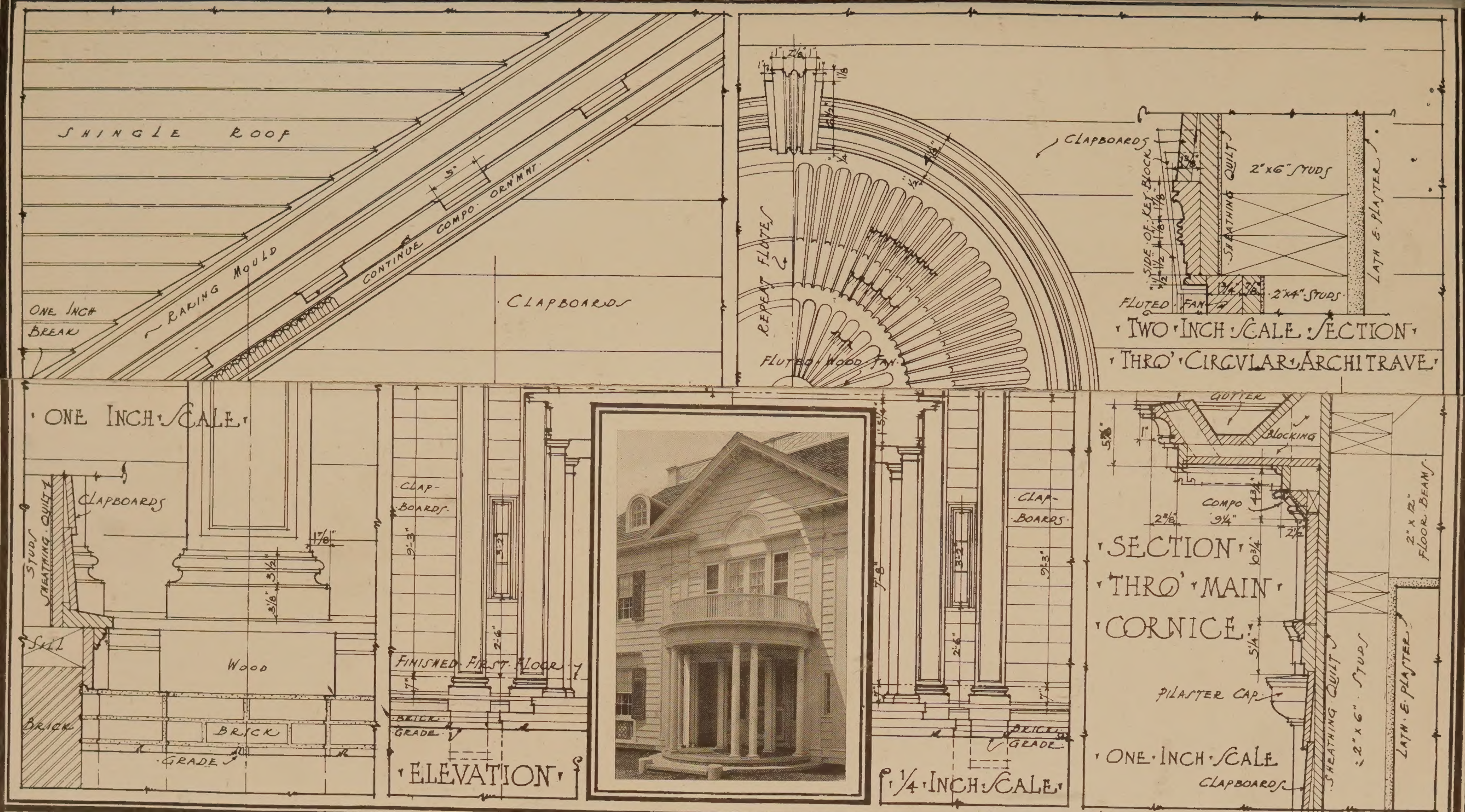

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